

### **IN THE CLAIMS:**

1. (Original) A method for bringing together and holding closed an open wound in human or animal flesh to allow healing and regrowth together of the two sides of the wound, comprising:

(a) in the open wound, inserting a surgical needle into flesh at one side of the wound, penetrating into the flesh wall at the one side, the needle having a base or trailing end secured to a one-way suture which has a series of exterior barbs providing for gripping of the flesh in one direction only, the barbs permitting movement of the suture through the flesh in the direction the needle is inserted,

(b) pushing the needle to extend out of the flesh at a point laterally spaced from the wound, then gripping the needle from the point end and pulling the needle out of the flesh, leaving a trailing end of the suture in the open wound,

(c) severing the suture from the needle,

(d) repeating the procedure of step (a) at the opposite side of the open wound, at a position to form a suture pair of two sutures located across the wound from one another,

(e) repeating steps (b) and (c) at said opposite side of the open wound,

(f) repeating steps (a) through (e) to form additional suture pairs as necessary at further locations along the wound depending on the size of the wound,

(g) bringing the two sides of the wound together, and

(h) connecting together trailing ends of the two sutures of each suture pair to bind the wound in a closed position.

2. (Original) The method of claim 1, wherein the step of securing together trailing ends of the sutures comprises binding together the two trailing ends by means of heat fusion.

3. (Original) The method of claim 2, wherein the suture is formed of nylon.

4. (Original) The method of claim 1, wherein the suture is formed of nylon.

5. (Original) The method of claim 1, wherein the suture has said barbs oriented at

progressively staggered positions around the periphery of the suture.

6. (Original) The method of claim 1, wherein the surgical needle is a detachable needle and wherein the step of severing the suture from the needle comprises, while conducting the step of pulling the needle out of the flesh, restraining the trailing end of the suture and pulling the needle with sufficient force to detach it from the suture at a position wherein the leading end of the suture is well below the surface of the flesh, thereby leaving the leading end of the suture within the flesh.

7. (Original) The method of claim 6, wherein the base end of the detachable needle has metric markings as a visual reference for a surgeon, and including the surgeon's predetermining the depth of needle-suture severing by detaching the needle at a desired depth by reference to the metric markings.

8. (Original) The method of claim 1, wherein the suture has a leading end region free of barbs, and wherein the step of pulling the needle out of the flesh comprises pulling the barb free leading end of the suture to the flesh, leaving the barbs well below the flesh so as to avoid downward tension at or near the surface of the skin.

9. (Original) A surgical method for bringing and holding together two tissue portions in a living patient or animal, to allow healing and regrowth together of the two tissue portions on either side of a tissue separation, comprising:

(a) at the tissue separation, inserting a surgical needle into tissue at one side of the separation, penetrating into the one tissue portion, the needle having a trailing end secured to a one-way suture which has a multiplicity of exterior barbs providing for gripping of the tissue in one direction only, the barbs permitting movement of the suture through the tissue in the direction the needle is inserted, the surgical needle being a part of a double-armed suture which includes first and second such surgical needles oriented in opposite directions and a single suture extending between the trailing ends of the two surgical needles, the suture having said exterior barbs oriented in one direction for a first portion of the length of the suture and in the opposite direction for a remaining, second portion of the length of the suture, each portion having the

barbs oriented so as to allow movement of that portion of the suture through the tissue in the same direction in which the needle secured to that portion of the suture is inserted,

(b) pushing the first surgical needle to extend along an intended line of support and then out of the tissue at a point spaced from the tissue separation, then gripping the needle from its point end and pulling the needle out of the tissue, leaving said second portion of the suture extending in the tissue separation,

(c) repeating the procedure of step (a) at the opposite side of the open wound, using the second surgical needle, at a position located across the tissue separation from the position in which the first needle was inserted,

(d) repeating step (b) at said opposite side of the tissue separation, to the extent that said second portion of the suture is drawn through tissue at said opposite side of the separation, with the second surgical needle,

(e) bringing the two tissue portions together, while drawing one or both of the surgical needles outwardly from the wound until the two portions of the suture are located substantially in respective tissue portions at opposed sides of the separation and the suture is drawn substantially tight so as to bind the two tissue portions together in a substantially closed position, and

(f) severing the suture from the two surgical needles.

10. (Original) The surgical method of claim 9, wherein the surgical needles are detachable needles, detachable from the suture with a prescribed pulling force, and wherein the step of severing the suture from the two surgical needles comprises, while conducting the step of pulling the needle out of the tissue, pulling each needle with sufficient force to detach it from the suture at a position wherein the trailing end of the needle is well below the surface of the tissue, thereby leaving the suture well below the surface of the tissue.

11. (Original) The surgical method of claim 10, wherein the two tissue portions comprise two sides of an open wound at the skin of a patient.

12. (Original) The surgical method of claim 9, wherein the suture is formed of nylon.

13. (Original) The surgical method of claim 9, wherein the suture is formed of a

resorbable material.

14. (Original) The surgical method of claim 9, wherein the two tissue portions are portions of a tendon which is at least partially severed.

15. (Original) The surgical method of claim 9, wherein the two tissue portions comprise two sides of an open wound at the skin of a patient, wherein the suture includes leading end regions free of barbs, adjacent to the trailing end of each surgical needle, and including leaving the barb free regions of the suture just below the skin to avoid pulling in of the skin.

16. (Original) A surgical method for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, comprising:

selecting one or more paths through the patient's tissue on which lines of tissue support are desired,

selecting a surgical needle of sufficient length to be inserted through a first of such selected paths in the tissue, the surgical needle having a trailing end secured to a one-way suture which has a multiplicity of exterior barbs providing for gripping of the tissue in one direction only, the barbs permitting movement of the suture through the tissue in the direction the needle is inserted,

pushing the needle into the tissue, below the skin and along the selected path for the desired line of tissue support, until the needle extends out through the skin at a distal end of the selected path,

gripping the needle from its point end and pulling the needle out of the patient's tissue, leaving the one-way suture lying within the tissue along the selected path,

severing the suture from the surgical needle, at a point below the skin, leaving a leading end of the one-way suture hidden beneath the skin at said distal end of the selected path,

as needed for the particular facelift operation, inserting a needle in additional selected paths for additional desired lines of tissue support, to place additional one-way sutures below the skin at said additional desired lines of tissue support,

applying tension to the trailing end of each suture, to engage the barbs against the internal tissue along said one or more desired lines of tissue support, and securing the trailing end of each

suture, in the tensioned condition, such that the desired line of support is placed in tension to provide the desired tissue support.

17. (Original) The surgical method of claim 16, wherein the trailing end of each suture is secured to tissue of the patient.

18. (Original) The surgical method of claim 16, wherein the trailing end of each suture is secured to a trailing end of another one-way suture which extends in essentially an opposite direction.

19. (Original) The surgical method of claim 16, wherein the surgical needle is a detachable needle which detaches from the suture under a prescribed degree of pulling force, and wherein the step of severing the sutures from the surgical needle comprises, while conducting the step of pulling the needle out of the tissue, restraining the trailing end of the suture and pulling the needle with sufficient force to detach it from the suture at a position wherein the trailing end of the needle is at a selected depth below the surface of the skin, thereby leaving the suture at said selected depth.

20. (Original) The surgical method of claim 19, wherein the surgical needle has near its trailing end metric markings as a visual reference for a surgeon, and including the surgeon's predetermining the depth of needle-suture severing by detaching the needle at a desired depth by reference to the metric markings.

21. (Original) A surgical method for bringing and holding together two tissue portions in a living patient, to allow healing and regrowth together of the two tissue portions on either side of a tissue separation, comprising:

(a) at the tissue separation, inserting a surgical needle into tissue at one side of the separation, penetrating into the one tissue portion, the needle having a trailing end secured to a one-way suture which has a multiplicity of exterior barbs providing for gripping of the tissue in one direction only, the barbs permitting movement of the suture through the tissue in the direction the needle is inserted,

(b) pushing the needle to extend along an intended line of support and then out of the tissue at a point spaced from the tissue separation, then gripping the needle from its point end and pulling the needle out of the tissue, leaving a trailing end of the suture in the tissue separation,

(c) severing the suture from the needle,

(d) repeating the procedure of step (a) at the opposite side of the tissue separation, in the other tissue portion, at a position to form a suture pair of two sutures located across the tissue separation from one another,

(e) repeating steps (b) and (c) at said opposite side of the tissue separation, in said other tissue portion,

(f) repeating steps (a) through (e) to form additional suture pairs as necessary at further locations in the tissue separation depending on the size of the tissue separation,

(g) bringing the two tissue portions together, and

(h) connecting together trailing ends of the two sutures of each suture pair to bind the tissue separation in a closed position to facilitate regrowth together of the two tissue portions.

22. (Original) The surgical method of claim 21, wherein the step of securing together trailing ends of the sutures comprises binding together the two trailing ends by means of heat fusion.

23. (Original) The surgical method of claim 21, wherein the two tissue portions comprise sections of a tendon of the patient.

24. (Original) The surgical method of claim 23, wherein the step of securing together trailing ends of the sutures comprises binding together the two trailing ends by means of heat fusion.

25. (Original) The surgical method of claim 21, wherein the two tissue portions comprise two sides of an open wound at the skin of a patient, and wherein the step of severing the sutures comprises severing the sutures below the skin surface.

26. (Original) The surgical method of claim 21, wherein the surgical needle is a detachable needle, detachable from the suture with a prescribed pulling force, and wherein the step of severing the suture from the surgical needle comprises, while conducting the step of pulling the needle out of the tissue, pulling the needle with sufficient force to detach it from the suture at a position wherein the trailing end of the needle is well below the surface of the tissue, thereby leaving the suture well below the surface of the tissue.

27. (Original) A surgical needle and suture combination, comprising:  
a surgical needle,  
a one-way suture having a series of exterior barbs providing for gripping of tissue in one direction only, the barbs permitting movement of the suture through tissue in the direction the needle is inserted,  
a detachable connection means securing the trailing end of the needle to a leading end of the suture, for releasing the needle from the suture when the needle pulls the suture with a prescribed amount of tension, and  
the needle having near its trailing end metric markings as a visual reference indicating distance from the trailing end of the needle, whereby a surgeon can predetermine a depth at which the needle is released from the suture by reference to the markings.

28. (Original) A method for producing one-way, barbed sutures of flexible monofilament material, for use in holding patient tissue in which the one-way suture is inserted, comprising:  
providing a suture filament material of about 100 to 500 microns,  
using a precision-formed cutting blade, cutting into the side of the suture filament material at an oblique angle, to a pre-selected depth,  
then removing the cutting blade to leave a barb on the side of the suture material with orientation in one direction of the suture, and  
repeating the cutting step at a series of locations along the length of the filament material and at different positions along the periphery of the filament to produce a length of one-way suture with barbs oriented in a common direction.

29. (Original) The method of claim 28, wherein the step of removing the cutting blade includes removing the blade in such a way as to cause the barbs to extend outwardly somewhat on the suture.

30. (Original) The method of claim 28, wherein the pre-selected depth of the barbs formed on the filament material is about 30 microns to about 100 microns.

31. (Original) The method of claim 28, wherein the cutting step is performed by a machine having a pair of parallel and moveable bars each with a plurality of cutting blades facing toward the suture material, the cutting blades being set at an oblique angle on the movable bars relative to the suture filament material, and including converging the bars with cutting blades inwardly and longitudinally relative to the suture filament material to form a series of barbs simultaneously.

32. (Original) The method of claim 31, wherein, on removal of the cutting blades, the bars are spread apart without longitudinal movement relative to the suture filament material, thus causing the formed bars to extend outwardly somewhat on the suture.

33. (Original) The method of claim 28, wherein the step of cutting in the suture filament material to form the barbs comprises using a pair of counter-rotating cutting wheels each having cutting blades on their outer surfaces, the cutting blades being set obliquely relative to the suture filament material which passes between the cutting blades, and including holding the suture filament material to impose a resistance against movement of the filament material with the motion of the cutting blades, the imposed resistance being sufficient to cause the cutting blades to cut into the sides of the filament material while still allowing the filament material to advance with the motion of the opposed cutting wheel, the imposed resistance also causing the barbs to extend outwardly somewhat on the suture.

34. (Original) The method of claim 28, wherein the barbs are formed at staggered positions along the filament material.



35. (Original) A method for producing one-way, barbed sutures of flexible monofilament material, for use in holding patient tissue in which the one-way suture is inserted, comprising:

providing a suture filament material of about 100 to 500 microns,

using a laser beam, machining the filament material to remove sections of material so as to produce barbs with orientation in one direction, thus producing a length of one-way suture with barbs oriented in a common direction.

36. (Original) The method of claim 35, wherein the barbs are at staggered positions along the suture.

37. (Original) The method of claim 35, wherein the barbs are formed in a spiral pattern on the suture.

38. (New) A method for producing a one-way barbed suture of flexible filament material, for use in holding patient tissue in which the one-way suture is inserted, comprising:

providing a suture filament material, having a side, a length, and a periphery,

providing a cutting blade,

cutting into the side of the suture filament material with the cutting blade at an oblique angle, to a pre-selected depth,

removing the cutting blade to leave a barb on the side of the suture filament material with orientation in one direction of the suture, and

repeating the cutting and removing steps at a series of locations along the length of the suture filament material and at different positions around the periphery of the suture filament material to produce a length of one-way suture with barbs oriented in a common direction.

39. (New) The method of claim 38, wherein the step of removing the cutting blade includes removing the blade in such a way as to cause the barbs to extend outwardly from the periphery of the suture.

40. (New) The method of claim 38, wherein the pre-selected depth of the barbs formed on the suture filament material is about 30 microns to about 100 microns.

41. (New) The method of claim 38, wherein the cutting step is performed by a machine having a pair of parallel and moveable bars each with a plurality of cutting blades facing toward the suture filament material, the cutting blades being set at an oblique angle on the movable bars relative to the suture filament material, and including converging the bars with cutting blades inwardly and longitudinally relative to the suture filament material to form a series of barbs simultaneously.

42. (New) The method of claim 41, wherein the step of removing the cutting blades comprises moving the bars apart without longitudinal movement relative to the suture filament material thus causing the formed barbs to extend outwardly from the periphery of the suture.

43. (New) The method of claim 38, wherein the step of cutting into the suture filament material to form the barbs comprises using a pair of counter-rotating cutting wheels each having an outer surface and having cutting blades on the respective outer surfaces, the cutting blades being set obliquely relative to the suture filament material which passes between the cutting blades, and including holding the suture filament material to impose a resistance against

movement of the suture filament material with motion of the cutting blades, the imposed resistance being sufficient to cause the cutting blades to cut into the side of the suture filament material while still allowing the suture filament material to advance with the motion of the opposed cutting wheels, the imposed resistance also causing the barbs to extend outwardly from the periphery of the suture.

44. (New) The method of claim 38, wherein the barbs are formed at staggered positions along the suture filament material.

45. (New) A method for producing a one-way, barbed suture of flexible filament material, for use in holding patient tissue in which the one-way suture is inserted, comprising:

providing a suture filament material,

providing a laser beam,

cutting the suture filament material with the laser beam to remove sections of material so as to produce barbs with orientation in one direction, thus producing a length of one-way suture with barbs oriented in a common direction.

46. (New) The method of claim 45, wherein the barbs are at staggered positions along the suture.

47. (New) The method of claim 45, wherein the barbs are formed in a spiral pattern on the suture.

48. (New) A method for producing a double-armed barbed suture of flexible filament material, for use in holding patient tissue in which the double-armed suture is inserted, the double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a second portion of the length of the suture, said method comprising:

providing a suture filament material having a side, a length and a periphery,

providing a cutting blade,

cutting into the side of the suture filament material with the cutting blade at an oblique angle, to a pre-selected depth,

removing the cutting blade to leave a barb on the side of the suture filament material with orientation in one direction of the suture, and

repeating the cutting step at a series of locations along the length of the suture filament material and at different positions around the periphery of the suture filament material to produce a length of one-way suture with barbs oriented in a common direction for a first portion of the length of the suture, and

repeating the cutting step in the opposite direction for the second portion of the length of the suture.

49. (New) The method of claim 48, wherein the step of removing the cutting blade includes removing the blade in such a way as to cause the barbs to extend outwardly from the periphery of the suture.

50. (New) The method of claim 48, wherein the pre-selected depth of the barbs formed on the suture filament material is about 30 microns to about 100 microns.

51. (New) The method of claim 48, wherein the cutting step is performed by a machine having a pair of parallel and moveable bars each with a plurality of cutting blades facing toward the suture filament material, the cutting blades being set at an oblique angle on the movable bars relative to the suture filament material, and including converging the bars with cutting blades inwardly and longitudinally relative to the suture filament material to form a series of barbs simultaneously.

52. (New) The method of claim 51, wherein the step of removing the cutting blades comprises moving the bars apart without longitudinal movement relative to the suture filament material, thus causing the formed barbs to extend outwardly from the periphery of the suture.

53. (New) The method of claim 48, wherein the step of cutting into the suture filament material to form the barbs comprises using a pair of counter-rotating cutting wheels each having an outer surface and having cutting blades on the respective outer surfaces, the cutting blades being set obliquely relative to the suture filament material which passes between the cutting blades, and including holding the suture filament material to impose a resistance against movement of the suture filament material with motion of the cutting blades, the imposed resistance being sufficient to cause the cutting blades to cut into the side of the suture filament material while still allowing the suture filament material to advance with the motion of the

opposed cutting wheels, the imposed resistance also causing the barbs to extend outwardly from the periphery of the suture.

54. (New) The method of claim 48, wherein the barbs are formed at staggered positions along the suture filament material.

55. (New) A method for producing a double-armed barbed suture of flexible filament material, for use in holding patient tissue in which the double-armed suture is inserted, the double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a second portion of the length of the suture, said method comprising:

providing a suture filament material,

providing a laser beam,

cutting the suture filament material to remove sections of material so as to produce barbs with orientation in one direction, thus producing a length of one-way suture with barbs oriented in a common direction for a first portion of the length of the suture, and

repeating the cutting step in the opposite direction for the second portion of the length of the suture.

56. (New) The method of claim 55, wherein the barbs are at staggered positions along the suture.

57. (New) The method of claim 55, wherein the barbs are formed in a spiral pattern on the suture.

58. (New) A surgical needle and suture combination, comprising:

a surgical needle having a trailing end,

a one-way suture having a series of exterior barbs providing for gripping of tissue in one direction only, the barbs permitting movement of the suture through tissue in the direction the needle is inserted,

a detachable connection means securing the trailing end of the needle to a leading end of the suture, for releasing the needle from the suture when the needle pulls the suture with a prescribed amount of tension, and

the needle having near its trailing end markings as a visual reference indicating distance from the trailing end of the needle, whereby a surgeon can predetermine a depth at which the needle is released from the suture by reference to the markings.

59. (New) The surgical needle and suture combination of claim 58, wherein the suture is a double-armed suture, the suture having a length and having said exterior barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a remaining, second portion of the length of the suture, and including two said surgical needles, each being secured by a respective said detachable means to respective opposite leading ends of the suture.

60. (New) The surgical method according to claim 16 for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, said method further including:

providing tissue support in the facelift operation from the sutures themselves.

61. (New) The surgical method according to claim 60 for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, said method comprising:

the one-way suture being a double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a remaining second portion of the length of the suture.

62. (New) The surgical method according to any one of claims 16 for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, wherein:

the one-way suture is a double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a remaining second portion of the length of the suture.

63. (New) The surgical method according to claim 17 for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, wherein:

the one-way suture is a double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a remaining second portion of the length of the suture.

64. (New) The surgical method according to claim 19 for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, wherein:

the one-way suture is a double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a remaining second portion of the length of the suture.

65. (New) The surgical method according to claim 20 for supporting skin and adjacent subcutaneous tissue of a patient in a facelift operation, wherein:

the one-way suture is a double-armed suture having a length and having barbs oriented in one direction for a first portion of the length of the suture and in a direction opposite to the one direction for a remaining second portion of the length of the suture.



66. (New) A machine for producing a barbed suture of flexible filament material, the suture filament material having exterior walls, the barbed suture being for use in holding patient tissue in which the barbed suture is inserted, said machine comprising:

a pair of movable and parallel bars, each of the two bars having a surface and set of cutting blades on each respective surface, the two sets of cutting blades being in facing relationship and being of a size and spacing to form the barbs in a desired size and spacing,

each of the two bars with the two respective sets of cutting blades being adapted to converge inwardly and downwardly in order to engage the two sets of cutting blades into the exterior walls of the suture filament material to produce cuts and adapted to be then removed from the cuts, thereby producing a barbed suture.

67. (New) The machine according to claim 66, wherein the bars are adapted for the blades to cut while the suture material is held stable and the bars are moved inwardly and downwardly.

68. (New) The machine according to claim 66, wherein the bars are adapted for the blades to cut while the suture material is advanced upwardly and the bars are moved inwardly.

69. (New) The machine according to claim 66, wherein the bars are adapted to be removed from the cuts by spreading the two bars outwardly, without longitudinal movement of the cut suture material.

70. (New) A machine for producing a barbed suture of flexible filament material, the suture filament material having exterior walls, the barbed suture being for use in holding patient tissue in which the barbed suture is inserted, said machine comprising:

a pair of rotatable cutting wheels, each of the two wheels a surface and set of cutting blades on each respective surface, the two sets of cutting blades being in facing relationship and being of a size and spacing to form the barbs in a desired size and spacing,

each of the two wheels with the two respective sets of cutting blades being adapted to converge inwardly and downwardly in order to engage the two sets of cutting blades into the

exterior walls of the suture filament material to produce cuts and adapted to be then removed from the cuts, thereby producing a barbed suture.

71. (New) The machine according to claim 70, wherein the wheels are adapted for the blades to cut while the suture material is held stable and the wheels are moved inwardly and downwardly.

72. (New) The machine according to claim 70, wherein the wheels are adapted for the blades to cut while the suture material is advanced upwardly and the wheels are moved inwardly.

73. (New) The machine according to claim 70, wherein the wheels are adapted to be removed from the cuts by spreading the two wheels outwardly, without longitudinal movement of the cut suture material.